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AUTHOR Crocker, Jennifer; Taylor, Shelley E.
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ABSTRACT

The influence of expectations and hypothesis testing on subjects' use of particular types of evidence to estimate covariations was investigated. Results of the first study indicated that all subjects relied most on positive confirming evidence and did not over-utilize evidence that was consistent with expectations. Results of the second study indicated that subjects reported seeing more instances which confirmed than disconfirmed their expectations, but subjects did not over-utilize the estimated frequency of expectation-consistent instances in their covariation judgments. Hypothesis-testing subjects relied most on the estimated frequency of hypothesis-confirming instances, while subjects who were not given a hypothesis to test did not appear to use any particular type of evidence to estimate covariation. (Author)

Theory Driven Processing and the Use of Complex Evidence[1]

Jennifer Crocker and Shelley E. Taylor

Harvard University

One of the tasks facing the social perceiver is estimating the degree of co-occurrence of attributes and events in the social environment. In order to arrive at a reasonably accurate estimate of co-occurrence or correlation, the social perceiver must collect data concerning the positive and negative (or high and low) instances of the event, and use those data in a prescribed manner involving arithmetic calculations. While estimating correlations would seem to be a time consuming and difficult task, social perceivers make correlation estimates about a wide variety of events. For example, everyone has an implicit personality theory about what traits correlate with each other (Hastorf, Schneider and Polefka, 1970), and everyone estimates the degree to which one's own behavior co-varies with one's outcomes, such as the more I drink at night, the worse I feel in the morning.

How does one reconcile the facts that judgments of covariation are common yet so difficult? The difficulty of the numerous steps involved in correctly estimating a correlation taken together with the ease with which such estimates are provided suggest that the actual process by which people judge correlations differs from the normative procedure that statisticians use to accurately estimate correlations (See Nisbett and Ross, in press). In fact, there is abundant evidence that people are particularly bad at estimating covariation. Several researchers have demonstrated that

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people make systematic errors in assessing the degree of covariation between two categories of events. These errors, or erroneous inferences about covariation are called illusory correlations. For example, Chapman (1967) showed that people consistently overestimate the degree of co-occurrence between two associated words, such as table and chair.

What is the source of illusory correlations? We hypothesized that schemas might be responsible for their occurrence. A schema is an enduring theory about some stimulus domain that is organized through experience. A schema provides a knowledge structure about the elements of a stimulus domain and the relationships among those elements. For example, "salesmen are extroverted" might be a very simple schema about salesmen. How might schemas lead to illusory correlations? Schemas contain information about what categories of events are expected to co-occur. We proposed that schematic processing might lead people to "see" those relationships which their schemas lead them to expect.

Much of the research on assessment of covariation has been interpreted as demonstrating that people over-rely on the number of instances which confirm whatever covariation they are asked to assess. For example, subjects assessing the covariation between cloud-seeding and rain use the frequency of instances in which cloud seeding was followed by rain, rather than using those instances plus the frequency of cloud-seeding-no rain, no cloud seeding-rain, and no cloud-seeding-no rain instances, as an unbiased strategy would dictate. This strategy has also been demonstrated in subjects assessing the covariation between their own behavior and outcomes (Jenkins and Ward, 1965) and in nursing students assessing the covariation between symptoms and diagnoses (Smedslund, 1963). Each of these studies that demonstrate illusory correlation can be interpreted as demonstrating that people over rely on

the frequency of schema-consistent cases when they assess covariation. We all know that scientists have developed somewhat effective cloud-seeding methods, nursing students should have well-developed schemas for symptoms covarying with diseases, and the illusion of control literature suggests that people overestimate the likelihood that their instrumental behavior will bring about a desired outcome (Langer, 1975). Thus, each of these studies has asked subjects to assess covariations that are consistent with their schemas. None of the previous research has looked at what subjects do when assessing a schema-inconsistent covariation.

We tested the hypothesis that people overestimate schema-consistent covariations but not schema-inconsistent covariations by having subjects read through a series of descriptions of people, and then estimate the degree of covariation between two of their attributes - hair color and eye color. Before reading the descriptions subjects were instructed to assess a schema-consistent or expected relationship (between blond hair and blue eyes) or a schema-inconsistent or unexpected relationship between brown hair and blue eyes). We predicted that both groups of subjects would use the number of schema consistent descriptions, rather than the number of descriptions which confirmed the relationship they were instructed to assess, to estimate covariation. As a result, people should be more likely to "see" an expected than an unexpected covariation in the descriptions.

The data analysis provided no support for our hypothesis. Both groups of subjects depended primarily on the frequency of cases which confirmed the covariation they were assessing, regardless of whether or not they were assessing a schema-consistent relationship. In other words, people assessing the blond hair-blue eyes covariation used the frequency of blond-blue instances as evidence, but people assessing the brown hair-blue eyes covariation used the frequency of brown-blue instances as evidence.

Why did we find no support for our hypothesis that schemas influence the

evidence one brings to bear in assessing covariation? There are a couple of uninteresting explanations and one interesting one. First, the uninteresting ones: It is possible that the descriptions we used were not appropriate. The descriptions provided very clear, unambiguous descriptions of hair color and eye color, and it is possible that schemas influence covariation judgments only under conditions of ambiguity. Alternatively, the descriptions may have elicited a relatively weak schema. Had we tapped a more powerful schema, our hypothesis might have been confirmed. Neither of these explanations was convincing to us, because the previous studies have demonstrated illusory correlations under conditions of no ambiguity and have drawn upon relatively unimportant or weak schemas.

The explanation we favor is that when people are testing a hypothesis, any hypothesis, they use hypothesis-confirming evidence; similar effects have been shown on an interactive task by Snyder and Swan (in press). But if no hypothesis is provided, they will fall back on their schema, and use schema-consistent evidence. In other words, when people are told what to look for, or are given a hypothesis before they see the evidence, as they were in our study, they will look for confirming evidence. When they are not told what to look for, they will look for information that fits their beliefs about the world and overutilize this schema-consistent evidence when making judgments.

To test our new hypothesis, that hypothesis-testers over-utilize hypothesis-confirming evidence, but that people who are not explicitly testing a hypothesis will fall back on schema-consistent evidence to estimate covariation, we conducted a second study. In this study subjects assessed either a schema-consistent or a schema-inconsistent covariation, and they either knew in advance or did not know in advance what covariation they would be assessing.

The actual level of covariation in the descriptions was varied within subjects. The descriptions in the study gave the occupation and a personality trait of an individual. For example, in one set of descriptions the schema-consistent descriptions were of extroverted salesmen, and the schema-inconsistent descriptions were of introverted salesmen. The remainder of the descriptions were schema-irrelevant, as determined by pre-testing-- extroverted or introverted bankers, in this case.

To summarize the design, subjects were instructed to assess the strength of a schema-consistent or inconsistent relationship, either before or after viewing the descriptions. These were the between-subjects factors. There were four levels of actual correlation in the stimuli; this was a within-subjects factor.

After reading through the descriptions, subjects estimated the degree of covariation in the descriptions and estimated how many of each of the four types of instances they had seen. For example, for one set of stimuli subjects estimated how many extroverted salesmen, introverted salesmen, extroverted bankers, and introverted bankers they had seen. We predicted that hypothesis testers, that is, those subjects who knew in advance what covariation they were assessing, would rely on the number of hypothesis-confirming instances while subjects with no hypothesis to test would fall back on their schemas and use the frequency of schema-consistent instances to assess the covariation.

The results are clearest if we present them on a cell by cell basis. First, consider subjects who were testing a schema-consistent covariation from the outset. Subjects who knew in advance that they were assessing a schema-consistent covariation thought the degree of covariation was high, thought there were more schema-consistent than schema-inconsistent descriptions, and used evidence which confirmed the hypothesis they tested. That is, they

used their estimated frequency of schema-consistent instances to assess covariation.

In comparison, consider subjects who assessed a schema-consistent covariation, but who were not told in advance what covariation they had to assess. These subjects thought the degree of covariation was high, and thought they saw more schema-consistent than schema-inconsistent descriptions, but they did not utilize any particular type of evidence to estimate the covariation. In other words, they behaved like subjects who did know in advance that they would be assessing a schema-consistent covariation, except they did not use their estimated number of confirming instances as the basis for estimating covariation.

Now consider subjects who were assessing a schema-inconsistent covariation. Subjects who knew at the outset that they were assessing a schema-inconsistent covariation thought the covariation was low, thought they saw more schema-consistent than schema-inconsistent descriptions,but used the estimated frequency of hypothesis-confirming or schema-inconsistent descriptions to estimate covariation.

Subjects who assessed a schema-inconsistent covariation and were not given a hypothesis in advance thought the covariation was low, thought they saw more schema-consistent than schema-inconsistent instances, and did not use any particular type of evidence to estimate the covariation.

What does this tell us about the relationship between schemas, hypotheses, and the assessment of covariation? First, schemas: subjects were more likely to see an expected than an unexpected covariation, and they thought they saw more schema-consistent than schema-inconsistent descriptions. Second, what was the effect of knowing in advance what covariation was to be assessed? The effect of knowing what covariation to look for seems to be that people with a hypothesis search the data for hypothesis-confirming instances, whether that hypothesis fits a schema or not, and use the estimated frequency of hypothesis-confirming instances to estimate covariation. People who do not have a hypothesis in advance do

not use any particular type of evidence when estimating covariation. Thus, having a hypothesis in advance seems to enable people to select certain information as important to a judgment, to search particularly for that evidence, and use the results of the search to make a judgment.

What can we conclude? One of the main findings of this study is that people are more likely to "see" schema-consistent or expected covariations than schema-inconsistent or unexpected covariations. This was true regardless of whether people set out to test a schema-consistent or a schema-inconsistent hypothesis, and regardless of whether there was actually a schema-consistent or schema-inconsistent covariation in the descriptions. This result suggests to us that schemas are highly resistant to disconfirmation. That is, people do not seem to use disconfirming evidence appropriately to modify their schemas. Why might schemas be highly resistant to disconfirmation? One explanation may be that schemas, which are enduring beliefs based on experience, may provide a basis for interpreting ambiguous stimuli. A second reason that schemas are resistant to disconfirmation may be that schemas provide "best guesses" for filling in missing data and aiding recall of schema-consistent data. These best guesses would be based on experience and function like "default options" in a computer program, filling in reasonable values where data are missing (c.f. Minsky, 1975). The fact that subjects remembered more schema-consistent than schema-inconsistent instances in the present study fits either an interpretation of ambiguous stimuli" or a "best guesses - aid to call" explanation.

These data further suggest when new schemas will be acquired. New schemas will be acquired when a hypothesis is tested and an appropriate number of confirmations of the hypothesis are found. The presence of disconfirming evidence will be relatively ineffective in leading to a rejection of a schema-consistent hypothesis, however. These points suggest that it is easier to

acquire a new schema than it is to reject an old one.

Finally, the present study clears up a thorny problem in the literature on the assessment of covariation. In that literature, some studies have pointed to over-reliance on the frequency of confirming cases. Ward and Jenkins (1965) Jenkins and Ward (1965) and Smedslund (1963) provide examples of these studies. Others have reported that subjects are insensitive to the frequency or infrequency of confirming cases, as in studies by the Chapmans (1967, 1969). A review of these studies indicates that when subjects know in advance what covariation they will be assessing, they rely on the frequency of confirming cases, as subjects in our study who were told in advance what relationship to assess. In those studies in which subjects do not know in advance what covariation they will be assessing, subjects are relatively insensitive to the frequency of confirming cases, but report the expected relationships, like the subjects in our study who were not given a hypothesis to test.

In sum, the data you use is determined by what you are looking for, but what relationship you find is determined by your theories.

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